Forensic science and the myth of adversarial testing

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Abstract

This article explains why the adversarial trial has not been an effective mechanism for regulating the admission and use of many forms of forensic science evidence. Drawing upon mainstream scientific perspectives, and using an historical study of reported decisions involving latent fingerprint evidence, it documents how lawyers and judges never required forensic scientists to formally evaluate their procedures or express opinions in ways that are scientifically defensible. For more than a century every challenge to latent fingerprint evidence focused on legal and procedural issues, or the significance of fingerprints for the case. Questions about validity and scientific reliability (e.g. Can you do it? How accurate are you?) were not asked until 2015. The study shows that legal approaches and practices were, and are, insensitive to mainstream scientific perspectives on latent fingerprint evidence. It demonstrates that our practices around the admission and presentation of fingerprint evidence (and implicitly many other types of forensic science and medicine) are fundamentally misconceived, that our lawyers and judges genuinely struggle with technical evidence, and that our legal institutions have developed rules and commitments that prevent them from receiving the benefits of mainstream scientific research and advice.

Keywords: trial, fingerprint, expert, evidence, cross-examination, safeguard, admissibility, history

His evidence was carefully given and thoroughly tested.
(Chief Justice Cullen, *R v Blacker* 1910, 360)

1. INTRODUCTION

The adversarial criminal trial is conventionally presented as an evolved procedure, carefully calibrated to producing accurate outcomes in ways that satisfy the changing values of constituent societies. Adversarial trials are based on the premise that allowing interested parties to collect, present and test evidence is effective – in terms of both rectitude (i.e. getting it right) and fairness, especially participation (Devlin 1979, 60-61; Duff et al 2004; *Ratten v The Queen* 1974, 517). Indeed, the ability to adduce evidence and test witnesses through cross-examination, with the assistance of legal counsel, is said to engender an 'equality of arms' between the defendant and the state (*Dietrich v The Queen* 1992, 354; *BA v Attorney-General* 2017; Jackson 2009). Beyond cross-examination, modern adversarial criminal trials feature many additional *safeguards*, ranging from the responsibilities of the prosecutor as a minister of justice, rules regulating the disclosure and admissibility of evidence, allowing the defendant to speak (or remain silent) and call witnesses, to careful instruction by an impartial trial judge on the high standard of proof burdening the state, as well as provision for appellate review (Edmond 2019b). Together, these values, rules and procedures are said to encourage rectitude and fairness while contributing to institutional legitimacy (Twining 1985, 117). They apply to all proffered evidence, whether the testimony of ordinary witnesses or the complex statistical evidence associated with modern forms of DNA profiling.

In this article we show that conventional claims about the adversarial trial, and assumptions about testing are, with respect to much scientific, medical and technical evidence adduced by the state, complacent and misguided. Through a detailed survey of

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the reception of latent fingerprint evidence, we illustrate how the state's forensic science evidence is taken on trust, hardly ever questioned, let alone tested, and never presented in a manner that reflects its known value. On the few occasions where epistemologically-oriented questions are posed – following a recent chorus of mainstream scientific criticism – judicial officers have been disinclined to take methodological problems seriously. Rather, they have demonstrated a tendency to rely on the postulated effectiveness of adversarial procedure and the tactical (and other) discretions vested in the defence. Drawing upon empirical evidence, this article suggests that with respect to much forensic science evidence our adversarial procedures and safeguards have not worked well and that the defence 'arm' is weak, perhaps atrophied.

This article reviews challenges to latent fingerprint evidence in Australia over the past one hundred years (see, more generally, Cole 2001; Beavan 2001; Sengoopta 2003). Drawing upon reported decisions, mostly appeals beginning in 1910, it reviews the way fingerprint evidence has been presented and contested. The results are revealing. Our survey located thousands of references to fingerprints in the main case databases. The majority are bare references: frequently referring to enabling legislation (e.g. *Crimes (Forensic Procedures) Act 2000* (NSW)) or equating the declaration of a match decision with the categorical (or unqualified) identification of a specific person. In the vast majority of cases the evidence is not contested. There were, however, hundreds of challenges to latent fingerprint evidence. Almost every one of these challenges was based on some kind of procedural or legal issue. Over more than a century of use we found only two epistemologically-oriented challenges to identification by fingerprint. Both were unsuccessful and, for reasons explained below, any insights or lessons are unknown to law.

At its core this article is about legal failure, specifically the persistent failure of adversarialism, and its oft-celebrated safeguards, with respect to much forensic science evidence (Edmond and San Roque 2012). It helps to explain why forensic scientists should not use the admission of opinions or reliance by courts as a meaningful substitute for rigorous scientific evaluation of procedures. It illustrates why courts cannot confer epistemological legitimacy upon forensic science procedures. To that end prosecutors, defence counsel and judges should be far less complacent about the effectiveness of quotidian criminal procedures and their ability to identity or explain significant limitations with evidence presented as scientific, medical or technical. The article also suggests that technical illiteracy amongst lawyers and judges (and some forensic scientists) may have more debilitating professional and institutional dimensions than has previously been recognised. For, during the first century of use, Australian lawyers and judges did not effectively scrutinise or regulate the most prominent forensic science. Potentially powerful procedural mechanisms and safeguards lay dormant.

A. Our Method

This article is based on a review of *reported* decisions. That is, those decisions included in published law reports and/or readily available on electronic databases. It relies particularly heavily on cases that have been treated as authoritative (Edmond 2019a). Austlii and Westlaw AU were searched using search terms such as 'fingerprint /p admiss*' and 'fingerprint /20 reliab*'. Prior to 1980, the search was expanded to include any case referring to 'fingerprint', 'finger-print', 'finger print' or 'finger mark' (n=3019, 14 June 2019). Terms such as 'ACE-V', 'point', 'superglue' and 'Livescan' were searched to trace specific issues. 'Note-up' was used to search for citations to prominent cases such as *R v Blacker* (1910), *R v Parker* (1912), *R v Lawless* (1974), *R v Bennett* (2005) and *JP v DPP* (2015). Finally, we searched for references to a number of seminal

scientific reports – discussed below (e.g. 'NAS', 'National Academy of Sciences' and 'Strengthening Forensic Sciences') – as well as our own scholarly publications on the forensic sciences and fingerprint evidence (e.g. Edmond et al 2014a, 2014b).

We acknowledge that this method of searching may not generate comprehensive results. There may have been, for example, trials where fingerprint evidence was actively contested and even excluded – on reliability (i.e. epistemological) grounds – that were not appealed or reported. Though, that seems unlikely given liberal admissibility practices and accommodating judicial attitudes. Regardless, one of the advantages with our method is that if reliability challenges were readily accessible we should have located them. What our research suggests is that if insights did manifest they have been lost or forgotten. They form no part of modern legal consciousness and there is no trace of them in modern judgments (LoPucki 1996; Judicial Commission 2002). This study provides an overview of decisions and strategies that were, and continue to be, readily available to practicing lawyers and judges. Exploiting the institutional significance attached to appellate decisions, it purports to present what was and is *legally* known about latent fingerprint evidence and the main ways in which lawyers conceptualised and contested the admissibility and use of that evidence across more than a century.

Already, we have alluded to different types of challenge to latent fingerprint evidence. Using somewhat Manichean categories, the challenges to latent fingerprint evidence described in this article are divided into two basic types. We characterise these as *adjectival* and *epistemological*. Adjectival challenges are focused on some breach of a rule or procedure, or claim about unfairness. They are concerned, for example, with issues such as: whether reference fingerprints were lawfully collected; whether the prints of a minor can be used for comparison; whether disclosing the match to the trier of fact implied that the defendant had a criminal record (because prints were on file); whether the trier of fact was entitled to undertake its own assessment of the prints; and, the appropriateness of any judicial direction or warning. They might be extended to those cases where the meaning of fingerprint evidence is contested. Epistemological challenges, in contrast, focus on reliability issues pertaining to the identification.[1] These include: the validity and accuracy of the procedure; the proficiency of the examiner; the form in which the opinion is expressed (e.g. as a categorical opinion about identity); and the manner in which human factors (e.g. cognitive bias) are managed. Put simply, adjectival challenges are concerned with rules, procedures and fairness (narrowly conceived) whereas epistemological challenges are concerned with the validity and accuracy of identification by latent fingerprint evidence. We have elected to take advantage of the categories 'adjectival' and 'epistemological' because they provide a stark indication of just how overwhelming were non-epistemological challenges.

B. Noticing scientific knowledge

This review and analysis relies heavily on scientific research and a range of recent independent reports on feature comparison forensic sciences, including latent fingerprint comparison. Recent reviews by peak scientific and technical organisations have reported concerns, offered advice and stimulated research in ways that have made it possible to make an informed assessment of a century of legal practice. The following discussion draws upon reports prepared by the National Research Council (NRC 2009) of the US National Academy of Sciences, the US National Institute for Standards and Technology (NIST 2012), the President's Council of Advisers on Science and Technology (PCAST 2016), the American Association for the Advancement of Science (AAAS 2018),

[1] All challenges necessarily have legal dimensions, but epistemological challenges are focused on some aspect of the reliability of the identification.

guidelines prepared by the UK Forensic Science Regulator (2017, 2019), along with inquires following notorious mis-identifications in the cases of Brandon Mayfield in the US (Office of the Inspector-General 2006) and Shirley McKie in Scotland (Campbell 2012).[2]

Latent fingerprint examiners routinely report their opinions about whether two impressions of friction ridge skin (usually fingerprints, but also palm and footprints) match. They equate match decisions with the positive (or categorical) identification of a specific person. To be clear, the scientific reports recognise that fingerprint comparison has considerable value (e.g. PCAST 2016, 9, 87ff), but all have questioned claims about the 'method' used by latent fingerprint examiners along with the move from a match decision to categorical identification. The modern incarnation of the method, combining *analysis, comparison, evaluation* and *verification* (by a second examiner), is conventionally referenced by its acronym ACE-V (Ashbaugh 1999). ACE-V is regularly invoked as a procedure capable of supporting categorical identification that is practically infallible.

According to the report prepared by the NRC:

> Although there is limited information about the accuracy and reliability of friction ridge analyses, claims that these analyses have zero error rates are not scientifically plausible.
>
> ACE-V provides a broadly stated framework for conducting friction ridge analyses. However, this framework is not specific enough to qualify as a validated method for this type of analysis. ACE-V does not guard against bias; is too broad to ensure repeatability and transparency; and does not guarantee that two analysts following it will obtain the same results. For these reasons, merely following the steps of ACE-V does not imply that one is proceeding in a scientific manner or producing reliable results. (NRC 2009, 142-43; NIST 2012, 8-9; PCAST 2016, 66-81)

In consequence, the general advice is that latent fingerprint examiners should be more circumspect with their conclusions (NRC 2009, 142). According to the NIST report (2012, 72), they 'should not report or testify, directly or by implication, to a source attribution to the exclusion of all others'. Beyond proscription on categorical identification (sometimes labeled individualisation, see Cole 2009; Saks and Koehler 2008), the reports cautioned about the risks posed by cognitive bias (Dror et al 2006), and recommended applying ACE in a linear fashion in conjunction with independent (or blind) verification (NIST 2012, 51-52, 65; AAAS 2018, 8; Krane et al 2008; Dror et al 2015). Several of the reports criticised examiner recourse to uniqueness and reliance on the few publicised errors as proxies for accuracy (PCAST 2016, 61-63; AAAS 2018, 13-14; Cole 2005; and the discussion in Section 5.C). All insist on the need for independent scientific testing – i.e. validation – to enable the evaluation of the procedure (and proficiency of examiners). Prior to the review conducted under the auspices of the National Academy of Sciences in 2009 latent fingerprint comparison had never been validated (NRC 2009, 143; Haber and Haber 2008).

The two most recent reports, by PCAST and the AAAS, are particularly apposite to this study and its findings. We recommend them to readers, but wish to emphasise the following points. First, when commenting on the assessment of feature comparison forensics (such as DNA, latent fingerprints, ballistics, toolmarks, documents, voices, persons of interest in images, and so on), PCAST (2016, Ch 4) insisted that the focus should be on validity and scientifically reliability rather than the experience of examiners, training and certification programs, the history of use, and so on. The conclusion of a

[2] On whether these reports are applicable to the forensic science in Australia, see Edmond (2015c), Edmond and Martire (2017b) and Lander (2017).

section of its report entitled ‘Scientific Criteria for Validity and Reliability of Forensic Feature-Comparison Methods’, states:

> We note, finally, that neither experience, nor judgment, nor good professional practices (such as certification programs and accreditation programs, standardized protocols, proficiency testing, and codes of ethics) can substitute for actual evidence of foundational validity and reliability. The frequency with which a particular pattern or set of features will be observed in different samples, which is an essential element in drawing conclusions, is not a matter of “judgment.” It is an empirical matter for which only empirical evidence is relevant. Similarly, an expert’s expression of *confidence* based on personal professional experience or expressions of *consensus* among practitioners about the accuracy of their field is no substitute for error rates estimated from relevant studies. For forensic feature-comparison methods, establishing foundational validity based on empirical evidence is thus a *sine qua non*. Nothing can substitute for it. (PCAST 2016, 6; White et al 2014)

Secondly, in order to be able to understand the value of feature comparison evidence, PCAST explains that it is essential to include information about the probability of the match or the likelihood of error. Specifically, in relation to latent fingerprint evidence, and in response to the risk that decision-makers might overvalue the evidence, PCAST recommends that latent fingerprint examiners should incorporate the best available estimate of error – based on validation studies – when reporting results. The Committee explains:

> PCAST finds that latent fingerprint analysis [has] *a false positive rate that is substantial* and *is likely to be higher than expected by many jurors* based on longstanding claims about the infallibility of fingerprint analysis. The false-positive rate could be as high as 1 error in 306 cases based on the FBI study and 1 error in 18 cases based on a study by another crime laboratory. In reporting results of latent-fingerprint examination, it is important to state the false-positive rates based on properly designed validation studies. (PCAST 2016, 9–10, 26, 74, italics added; AAAS 2017, 9, 73)

These results were derived through the first-ever validation studies (Ulery et al 2011, 2012; Tangen et al 2011) and indicate how an opinion about a match might be reported if it is to be susceptible to rational evaluation (Koehler 1996; Edmond 2015a). Importantly, these results confirm that fingerprint examiners possess genuine expertise. They perform much better than non-examiners, but nevertheless make small numbers of false positive errors. These results are inconsistent with the way fingerprint examiners report their opinions and describe the accuracy of their procedures.

Finally, the AAAS report suggests, along with the NRC and PCAST reports, that fingerprint examiners are implicated in the unsatisfactory state of affairs:

> Public perceptions of latent print examination have undoubtedly been shaped by *decades of overstatement.* One of the problems that examiners now face when attempting to convey a more realistic and appropriate sense of the value of latent print evidence is that people generally think a reported association between a latent print and reference print constitutes a virtually infallible identification. In our view latent print examiners should take affirmative steps, when reporting their findings, to address these common misconceptions. (AAAS 2018, 71, italics added)

Our study suggests that prosecutors, judges and defence counsel are complicit and must also take affirmative action to address epistemological disinterest and adversarial mechanisms that have repeatedly – though unexpectedly – failed in relation to latent fingerprint and many other types of scientific, medical and technical evidence adduced by the state.

These mainstream scientific perspectives are invoked to provide a knowledge benchmark against which to consider legal practice. Juxtaposition reveals that Australian (and other) courts admitted latent fingerprint (and many other types of forensic science) evidence without ever knowing, or requiring much in the way of *knowledge*, about its probative value or limitations (Edmond 2019a). Prior to independent scientific study many of the risks and dangers with the procedures and claims, on those rare occasions when raised, were pre-emptively dismissed by examiners. That Australian courts admitted latent fingerprint evidence without any independent scientific evidence of its validity and accuracy might surprise readers. The decision to allow fingerprint examiners to make categorical identifications seems to be a convention informed by legal credulity and tradition rather than scientific knowledge.

2. AUSTRALIA'S PARLOUS ADMISSIBILITY CONDITION

Admissibility rules and practice have contributed to unsatisfactory legal responses to the forensic sciences. Australia is a federal system and, as in the United States, the various states and territories are responsible for rules of evidence and procedure. Some of the states persist with a common law approach to evidence modified by ever-expanding statutory intervention. In these jurisdictions the admissibility of expert opinion evidence is shaped by English jurisprudence, dating back to *Folkes v Chadd* (1782), *R v Silverlock* (1894) and *R v Turner* (1975), though modified by Australian decisions such as *Clark v Ryan* (1960) and *R v Bonython* (1984). It requires those recognised as experts to be qualified (or experienced) in a field of knowledge (or study) and to offer some kind of assistance to fact-finding. Most of the states and territories have revised the common law. They now rely upon uniform legislation – the uniform evidence law (UEL) – gradually adopted since 1995.

Section 79 of the UEL (like FRE r 702) is an exception to the general prohibition on opinion evidence in s 76. It provides:

> **79 Exception: opinions based on specialised knowledge**
> (1) If a person has specialised knowledge based on the person's training, study or experience, the opinion rule does not apply to evidence of an opinion of that person that is wholly or substantially based on that knowledge.

Unremarkably, this rule has been read to require that (i) the opinion must be wholly or substantially based on 'specialised knowledge', and (ii) the 'specialised knowledge' must be based on 'training, study or experience' (*HG v The Queen 19*99). Some courts render the need for 'specialised knowledge' explicit as a third requirement. What is remarkable, in international perspective, is how Australian judges have drawn upon the US Supreme Court's *Daubert v Merrell Dow Pharmaceuticals, Inc.* (1993) decision to assist with the interpretation of 'knowledge' but explicitly repudiated *reliability* as a criterion of admissibility (Edmond, 2019). Unhelpfully, Australian jurisprudence insists that 'the focus of attention must be on the words "specialised knowledge", not on the introduction of an extraneous idea such as "reliability"' (*R v Tang* 2006, [137]; *Tuite v The Queen* 2015, [70]; *Chen v R* 2018, [62]). Not only is the relationship between knowledge and reliability unclear, but Australian judges have been unwilling to furnish any guidelines or criteria to assist with admissibility challenges and determinations (e.g. *Honeysett* 2014; Edmond 2015a, 2015b). Indeed, in one of the leading decisions the High Court indicated that 'in many, perhaps most, cases' the requirements of s 79 can be satisfied 'very quickly and easily … once the witness has described his or her qualifications and experience, and has identified the subject matter about which the opinion is proffered' (*Dasreef Pty Ltd v*

*Hawchar 2*011, [37]; Edmond and Martire 2017a). Fingerprint evidence seems to be exemplary (*Tang 2*006; *JP v DPP* 2015, [43]).

In practice there is little difference between the UEL regimes and those persisting with the Australian common law. All Australian courts are much more concerned with formal qualifications, experience and previous admission (in Australia or elsewhere) than with reliability (and validity) and demonstrable abilities (Martire and Edmond 2017). There has been little appellate engagement with the desiderata of knowledge, even when opinions purport to be scientific, medical or technical.[3]

Australian disinterest in reliability extends to 'discretionary' exclusion. Rules allowing or mandating exclusion, where the probative value of the evidence is *outweighed* by the danger of unfair prejudice to the defendant (UEL ss 135 and 137; similar to FRE r 403), have also been interpreted in ways that prevent exclusion. When determining the probative value of the evidence in order to undertake the balancing exercise, trial judges are not to evaluate the reliability of the evidence or the credibility of the witness. Rather, they are to take the evidence 'at its highest' – to consider *the capacity* of the evidence – as if it were 'accepted' by the jury (*IMM v The Queen 2*016; Roberts 2017; Hamer 2017; Edmond 2017). In conjunction with s 79, these rules have prevented lawyers (and judges) from making admissibility arguments (and assessments) pertaining to the reliability of forensic science evidence (Edmond 2015a).

The upshot is that Australian courts are required to consider whether opinions are based on 'specialised knowledge', whether that 'specialised knowledge' is based on 'training study or experience', and whether the probative value of the evidence is outweighed by the danger of prejudice to the defendant, but they are not required (or perhaps even allowed) to engage with reliability (and validity). Unlike our international common law comparators, Australian judges cannot consider the reliability of the opinion or the underlying procedure (Edmond 2019b). Questions about the reliability of evidence seem to be exclusively for the adversarial trial and the trier of fact. Admissibility standards in many regards are little better than an epistemic farce – putatively concerned with rectitude and fairness, they exclude relatively little opinion evidence adduced by the state.

Because admissibility decision-making is unconcerned with reliability (and validity, error, actual ability, cognitive bias and so forth) trial safeguards assume an extremely important role in Australian adversarial practice. Trial safeguards include: prosecutorial obligations; disclosure; the provision of defence counsel; scope for cross-examination; the possibility of defence/rebuttal experts; compliance with Codes of Conduct for expert witnesses (emphasizing impartiality and the primary duty to the court); detailed reports incorporating reasons, limitations and uncertainty; the burden and standard of criminal proof; and judicial directions and warnings. Australian courts assume that adversarial procedures, the motivations of the parties to collect evidence and use the rules and safeguards available to them, will place decision-makers – whether trial judge or jury – in a position to make rational determinations (e.g. *Gilbert v R* 2000, [13]; Edmond 2015a). As we shall see, quotidian adversarial proceedings may not provide an effective means of regulating the admission, presentation and evaluation of forensic science evidence. They are certainly not consistently effective, and entrenched attitudes and beliefs – as much as limited resourcing, credulity, and technical incapacity – may help to explain persistent problems.

What the following survey clearly demonstrates is that trial safeguards did not generate an endogenous legal awareness of uncertainties and limitations with latent

[3] DNA profiling is exceptional in this regard and is discussed in Section 7.

fingerprint evidence (and many other forensic sciences). More than a century of exposure has not produced sophisticated legal understanding. Lawyers and judges rarely question the epistemological hubris of categorical identification. This is a pity because the identification of limitations and managing their implications are the responsibility of trial safeguards in Australian adversarial criminal proceedings.

3. FINGERPRINT EVIDENCE IN AUSTRALIAN CRIMINAL PROCEEDINGS

Fingerprint evidence was used in investigations and prosecutions in the decade before it first appeared in reported decisions. Though, notwithstanding reports in newspapers, archived transcripts and professional histories, the law reports remain the most accessible and authoritative resources available to generations of lawyers and judges. The first reported Australian fingerprint decisions appear in the years immediately after the first appeal in England – namely *R v Castleton* (1909). In *R v Blacker* (1910) and *R v Parker* (1912) the NSW and Victorian Courts of Appeal confirmed the admissibility of fingerprint evidence, even though admissibility per se was not a ground of appeal confronting either court.

A. Over-claiming: Categorical identification

From its very first appearances in Australian legal proceedings latent fingerprint evidence has been presented and continuously accepted as complete proof of identity. Latent fingerprint examiners, prosecutors and judges consistently present and treat latent fingerprint evidence as incontrovertible proof that a particular person touched an object.

These practices are visible in the very first reported decisions in, respectively, *Blacker* (1910, 361-2) and *Parker* (1912, 153):

> … the witness arrived at the conclusion that the finger marks were made by the same person.

> … he was of opinion that, the prisoner's finger must have made the print on the bottle.

Categorical identification continued throughout the 20th century and beyond. From an abundance of instances, consider:

> The black garbage bag was later shown to have the fingerprints of the respondent on it … (*R v Qi* 2019, [25])

> A fingerprint on the outside of the box was identified as that of the offender … (*R v Aljubouri* 2019, [36])

> A fingerprint lifted from the handle of the knife was compared with a fingerprint sample from the Offender and was found to be a match. (*R v Cahill (No 4)* 2018, [150])

These recent examples are revealing. They indicate how, even after the NAS, NIST, PCAST and AAAS reports and their recommendations (discussed in Section 1.B), Australian latent fingerprint examiners continue to make categorical identifications that are understood and accepted as unequivocal evidence of identity.

B. Over-claiming: A practically infallible method

On those occasions when fingerprint evidence has been questioned, examiners (as well as prosecutors and judges) have tended to overlook or trivialise methodological limitations and uncertainties. Indeed, on those rare occasions when examiners were asked about their

methods, they demonstrate a tendency to assert that their methods are effectively error free and courts reciprocate by admitting the testimony and frequently taking such claims (and their implications) at face value. Consider, for example, the report of the way the examiner characterised his method and ability – predicated on uniqueness (discussed in Sections 5.A and C) – when cross-examined during O'Callaghan's trial in 1975. Whether the jury was entitled to undertake their own comparison of the latent and the reference prints was a live issue.

> Under cross-examination the expert said: "I have never been proved wrong on fingerprint identification, but the problem is it takes five years to train a fingerprint man, and members of the jury can see something in a fingerprint which they would consider makes it not in when in fact it is in." He was led into repeating and re-affirming his view that the impressions shown in Exhibits "B" and "C" were identical. Then after a lengthy cross-examination this question was put to him: "Would you go so far as to say that there are not and never have been any two prints which are the same as each other?" to which he replied, "I will, yes." Not content with that answer counsel persisted and finally these questions and answers were asked and given "You would say that never in the history of the world has there been a person born with the same fingerprint as somebody else? - From my studying of text books and the findings of other as you call scientists, and from my own examination of ridge characteristics occurring in fingerprints I have examined, I would say most emphatically no. "I take it you go a step further and say it is just not possible for such a thing to occur? - I would say yes, unless that impression was made by the same finger." (*R v O'Callaghan* 1976, 677)

More recently in *JP v DPP* (2015), years after the NAS and NIST reports had been published and widely disseminated, a NSW Police examiner was asked more directly about his method. In one of a series of exchanges during cross-examination we encounter the following:

> **Q.** Do you agree that there are a number of potential sources of error associated with your ACE-V technique of fingerprint examination and identification?
> **A.** If the ACE-V methodology is done correct I don't agree that there's potentially error rates there. …
> **Q.** Is it possible that you have made a mistake or mistakes in your examination of fingerprint impressions in this case?
> **A.** No I haven't.
> **Q.** Is it possible that you're wrong about the accused being the source of the fingerprint impression in W3?
> **A.** No I'm not.
> **Q.** In every case in which you've identified a latent print to a known print have you been a hundred per cent certain?
> **A.** Yes I have.
> **Q.** You've never had any doubt?
> **A.** Never. …
> **Q.** You agree don't you that fingerprint examination and identification is subject to human error?
> **A.** There's always an element of human error in anything we do.
> **Q.** But you say because of the method that you use that you're always right when you make an identification is that what you say?
> **A.** Me personally yes.
> **Q.** So you would say that the ACE-V method is infallible is that what you say?
> **A.** In the correct - used in the correct method and way and by myself yes. (*R v JP* 2015, January 27: 10-13)

In *O'Callaghan* the defence was blamed for the questionable responses because they were elicited through cross-examination. In *JP*, trial and appellate judges considered the examiner 'unshaken'. These examples suggest that, on the rare occasions when scientifically untenable claims were exposed, Australian courts were either unperturbed

or willing to leave them for the trier of fact to resolve (in the absence of background information and scientific knowledge).

The appeal in *R v Parry* (2017), perhaps the most detailed of recent Australian appeals (after *JP v DPP*), provides no indication that experienced counsel and judges are aware of, or able to comment on, the various scientific reports. Consider the following description of the evidence. It suggests, as in *O'Callaghan* (and many other cases), that the latent and reference fingerprints are 'identical'.

> On 4 December 2012, fingerprint investigator Godden assessed the fingerprint material and concluded that two of the four "344" impressions" were identical to the right index fingerprint of the appellant and one was identical to the right ring fingerprint of the appellant. (*R v Parry* 2017, [12])

Contemporary fingerprint examiners continue to overstate the value of their opinions and abilities and continue to mis-represent the accuracy of their methods. What seems essential in our adversarial system, and we will return to this issue below, is that latent fingerprint examiners (in reports and testimony), prosecutors and judges should all understand and present forensic science evidence in a manner that captures and conveys its known value. They should avoid convenient short-cuts, such as equating a match decision with categorical identification and implying that (the commitment to) uniqueness grounds error-free performance. Such claims tend to diminish the subjective nature of comparisons, trivialise limitations as well as risks introduced through inattention to cognitive bias. They also mislead on the reality or error.

4. ADJECTIVAL (OR NON-EPISTEMOLOGICAL) CHALLENGES

We now turn to consider formal challenges to latent fingerprint evidence. Most latent fingerprint evidence was not challenged, but when it was the overwhelming majority of challenges were *adjectival*. This section introduces some of the main issues raised in these non-epistemological challenges. It is not our intention to simply criticise these choices. On occasion, breaches of procedures and disclosure of past criminality threatened individual liberties, interests in privacy, risked confusing or misleading juries, and may have introduced degrees of unfairness into proceedings. Given prevailing beliefs and legal practices, adjectival challenges may have provided the best means of confronting fingerprint evidence. What concerns us is how challenges to the value of identification by fingerprint and the underlying procedures seem to have been almost inconceivable.

What the following discussion discloses, in the shadow of the mainstream scientific critique, is that very few lawyers understood that fingerprint evidence was in general (as well as in specific instances) vulnerable on epistemological grounds (Faigman, Monahan and Slobogin 2014). Resources and legal efforts were directed exclusively at issues that did not engage with the value of examiners' opinions for more than a century.

A. Use and provision of images: From *Blacker* to *Bennett*

The very first Australian fingerprint appeal, *R v Blacker* (1910), adjudicated on the way images of fingerprints had been used during the trial. Portions of the photograph of a latent fingerprint taken from a money box and Blacker's reference print had been enlarged and relied upon for the purpose of comparison and identification. The enlargement as well as the more complete image from which it was taken were both provided to the defence. The failure to enlarge the entire latent print, along with the use of the 'secondary evidence' of the images rather than produce the box, and limit the use of photographs to refreshing the witness's memory, were all raised as grounds on appeal.

In considering the admissibility of the enlarged images, the Chief Justice of NSW explained:

> Evidence was given that the enlarged photographs in the present case were carefully and accurately prepared under the supervision of the expert. The problem being to compare the two impressions, I am unable to see any reason why the comparison should not be made in this way by comparing photographic enlargements which are sworn to be accurate. Such photographs are in reality part of the expert evidence and used by the witness to illustrate and explain what otherwise the jury could not see for themselves, namely, the details which lead the expert to form his opinion that the two impressions are made by the same thumb. *If the evidence of the expert is to be tested at all it seems to me that it is necessary to allow his evidence of identification to be explained by something which is visible to the eye*. (*R v Blacker* 1910, 361 italics added)

The Court of Appeal unanimously dismissed the appeal.

Expectations from the early days of fingerprint evidence gradually fell away as complacent prosecutors and fingerprint examiners came to rely upon non-disclosure and anemic reports that provided little information to undemanding courts (Cf Risinger 2000, 135ff). Consider the response of the Chief Justice of South Australia, in 2005, to the defence concern that they could not adequately understand the fingerprint evidence or the examiner's reasoning without marked-up images of the fingerprints used in the comparison. The following, unhelpful, exchange occurred during cross-examination:

> **Q.** We find ourselves in court today and you're not in a position to tell us, are you, what characteristics you identified as being identical between the two prints.
> **A.** All I'm able to say is that the characteristics I found on the negative, I actually found on the ink set, there were no characteristics on the image on the negative which did not correspond to what was on the ink set. (*Bennett* 2005a, [11])

For Doyle CJ, and the Court of Appeal upholding his decision, admissibility was not affected by the failure 'to describe in detail what the witness observed, or to produce an image or representation of what the witness observed' (*Bennett* 2005a, [44]). He explained:

> The failure to tender the image referred to in item (4) was not, standing alone, an obstacle to the admissibility of the opinion that [the fingerprint examiner] expressed. It was proved, or not disputed, that [the examiner] had in his possession and had examined the images referred to in item (2) and item (4). The provenance of each image was established. As I have observed, each image was a relevant object in the prosecution's chain of proof, or an item of circumstantial evidence. No rule of evidence was identified in argument that requires a witness to produce a relevant object, or an image of the object, before the witness can describe to a court relevant features of the object observed by the witness. Nor, in my opinion, is there any such rule. (*Bennett* 2005a, [35]-[37])

The examiner could 'say' that 'identical features were found, without itemising them' (*Bennett* 2005a, [49]). Any oversights and omissions were issues for weight, to be explored by the defence through cross-examination. The trial was said to be fair because the defence was afforded 'the fullest opportunity to cross-examine' the witness (*Bennett* 2005, [16], [44], [47]; upheld in *Bennett* 2005b).

A hundred years after *Blacker* had deemed them 'necessary' for testing the evidence, the state's failure to produce a report that included images and reasons in advance of the trial was excused because these issues could have been explored via cross-examination at trial. Precisely how the defence was to seek instructions, take advice, and prepare for trial are not explained. For decades, the reports and certificates produced by most Australian fingerprint bureaus provided limited information. Most were non-compliant with

emerging Codes of Conduct and Practice Notes, slowly adapted from civil procedure rules (Edmond, Martire and San Roque 2017, 593-601; *Wood v The Queen* 2012, [728]).

B. Whether fingerprint evidence can satisfy proof beyond reasonable doubt

Following from the first reported common law decision, the English case of *R v Castleton* (1909), the issue of whether one or more fingerprints could support proof beyond reasonable doubt was raised from time to time in Australia (e.g. *R v Fitzgerald* 2005; *Chahine v The Queen* 2006; *R v Beattie* 2000, [19]; *R v Barbera* 1972). In *Parker* (1912; Gans 2011; Edmond 2019a) the Victorian Court of Appeal was asked whether a latent fingerprint detected on a ginger beer bottle found adjacent to a safe could be used to identify Parker and prove beyond reasonable doubt that he had robbed the premises. Without hearing from those responsible for originally delivering the ginger beer to the premises, the Court accepted that a single latent fingerprint could determine the identity of the robber and Parker's guilt beyond reasonable doubt.

Parker is sometimes referenced as the earliest Australian fingerprint case even though *Blacker* precedes it, and the examiner from *Blacker* appeared as a witness for the prosecution in *Parker* in support of his Victorian counterpart. We will return to *Parker* to consider the Chief Justice's sustained and nonpareil dissent. *Blacker* and *Parker*, along with obiter from the Chief Justice of Australia (more below), confirmed that identification by latent fingerprint was enough to convict.

C. Collection procedures

The largest group of challenges to latent fingerprint evidence is concerned with the procedures used to collect, obtain and store latent fingerprints.[4] Typically, these cases consider whether investigators had a proper basis for collecting the fingerprints and whether collection complied with evolving traditions of practice – from the Judge's rules to regularly revised, though increasingly permissive, statutory formulations. The typical application is to have the fingerprint evidence excluded on the basis of a breach of a rule or non-compliance with a procedure.

Though not focused on the admissibility of fingerprint evidence, *Sernack v McTavish* (1971) is illustrative. The appellant was charged and convicted of being without lawful excuse on the US embassy premises during an anti-Vietnam war protest in Canberra. At the police station Sernack identified herself but refused to have her fingerprints taken. She was subsequently charged and convicted of hindering a police officer in the execution of his duty. The issue on appeal concerned whether the 'Standing Instructions', issued by the Commissioner of Police and requiring that fingerprints be taken, was consistent with the discretionary power afforded by s353A of the *Crimes Act 1900* (NSW). Justice Fox explained:

[4] See e.g. *Western Australia v Cunningham (No 3)* [2018] WASCA 207; *Boski v Biffin* [2015] NSWSC 363; *R v SA, DD and ES* [2011] NSWCCA 60, [6]ff; *R v Carr (No 2)* [2011] NSWSC 724, [10], [27]; *Aydin v The Queen* [2010] VSCA 190; *R v Tang* [2010] VSC 578; *McNeill v The Queen* [2008] FCAFC 80, [113]–[120]; *R v McNeill (Ruling No 1)* [2007] NFSC 2, [104]ff; *Jabbour v Hicks* (2007) 183 A Crim R 297; *R v Fouyaxis (No 2)* [2007] SADC 62; *Lackenby v Kirkman* [2006] WASC 164; *R v Millard* [2006] ACTSC 56; *Maguire v Beaton* [2005] NSWSC 1241; *Pong Su (No 2)* [2004] VSC 492, [9]ff; *R v Delgado-Guerra; Ex parte A-G*, [2002] 2 Qd R 384; *R v Knight (aka Black)* [2001] NSWCCA 114; *R v Cvitko* [2001] SASC 72, [49]; *Lednar v Magistrates Court* [2000] VSC 549; *Cox v Robinson* [2000] QCA 454; *Mickelberg & Ors v The Queen & Anor* [1998] WASCA 55; *R v Sparkes* [1996] TASSC 106; *Grollo v Bates; Dessau; Macauley and Commonwealth of Australia* [1994] FCA 1293; *DPP v Morrison*, [1993] 1 VR 573 (consent); *R v Browning* (1991) 103 FLR 425; *Narburup v O'Brien* [1991] 1 NTLR 63; *R v McPhail* (1988) 36 A Crim R 390; *Bonder v Howell* [1984] WAR 76; *Fullerton v Commissioner of Police* [1984] 1 NSWLR 159; *Japaljarri v Cooke* (1982) 64 FLR 314; *Coxan v Mazey* [1981] Tas R 209; *R v Boland* [1974] VR 849; *Carr v The Queen* (1973) 127 CLR 662; *Trobridge v Hardy* (1955) 94 CLR 147.

> The power under S. 353A (3) is only to be exercised when the officer in charge forms the view that the finger-prints are necessary for the "identification" of the person in custody. … It is to be remembered too that the word is "necessary"; it is not sufficient that finger-printing is thought desirable. (*Sernack 19*71, 384)

The instructions issued by the Commissioner were found to be 'unlawful', leading to the setting aside of the conviction and penalty. Notwithstanding the existence of statutory requirements, such as those discussed in *Sernack*, the High Court confirmed, in *Carr v The Queen* (1972, 663), that there 'is nothing unlawful in asking a person, even if he be in custody, to provide fingerprints and, with his agreement, taking those fingerprints.'

Breach of procedure very occasionally led to civil litigation and the award of damages. In *Watkins v Victoria* (2010) the police officers involved in taking fingerprints exceeded their statutory authority. When the appellant resisted they used force that went beyond what was reasonable. Watkins was awarded substantial damages as a result of what became a serious assault.

These admissibility challenges, and a few civil suits, focus on compliance with rights and common law and statutory procedures. They seek to have reference prints, and the attendant identification, excluded (or removed from files) without addressing the validity and scientific reliability of the evidence. They implicitly accept the accuracy of any identification but seek to contest the admissibility of the evidence because of the manner in which reference samples were obtained. Civil cases seek damages for breach of procedures and intrusions upon the liberty and dignity (and other rights) of persons. Some cases involve attempts to have fingerprints removed from databases for privacy reasons (e.g. *CGG v Commissioner of Police (NSW) 2*017; *ACP v Commissioner of Police (NSW) 2*011) or attempts to resist providing fingerprints as a condition of employment (*Lee v Superior Wood Pty Ltd 2*019). There is nothing conspicuously epistemological about these challenges.

D. Who gets to compare the prints?

One of the issues that re-occurs, because the courts have not been particularly clear or consistent over time, concerns how the trier of fact should evaluate latent fingerprint evidence. In the early days some of the judges appear willing – as in *Blacker* – to undertake their own analysis or acknowledge their concurrence with the opinions of the police fingerprint examiner(s). Justice Hodges, in *Parker* (1912, 158), implies that the jury might undertake its own comparison:

> … the jury can see and judge for themselves as to the identity of the finger-marks, and the expert be merely a help to enable the jury to use the evidence of their own eyes.

Justice Cussen agreed, explaining that fingerprint examiners:

> … are not, in one sense, speaking as experts at all, but are merely pointing out to the jury matters which the jury could determine for themselves – they are simply convenient helpers of the Court. (*Parker* 1912, 159).

Over time a different approach gained ascendency. Rather than undertake their own assessment of the fingerprints, the jury was asked to consider the expert's opinion; particularly in relation to any features relied upon and the underlying reasoning. This was clarified in *R v Lawless* (1974, 423) where the Victorian Court of Appeal explained:

> We are of the opinion that the judge was right in his intervention. It is a matter for expertise not possessed by the ordinary run of mankind to identify characteristics of fingerprints and their patterns

> in each of two prints and make a comparison and form a conclusion as to whether they are identical or not and the jury could not be invited or allowed to act as experts. That is not to say of course that the jury could be prevented from examining the exhibits for the purpose of determining whether they were satisfied to the necessary degree by the evidence of the witness. The determination was for them, but the provision of evidence was for the experts.

Lawless, endorsed in *O'Callaghan* (discussed in Section 3.B), seems to embody the emergent, more deferential, orthodoxy.

Decades later, when *R v Bennett* (discussed in Section 4.A) was appealed to the Supreme Court of South Australia, Perry ACJ offered a model of good practice. The judgment begins with a reference to *Parker*:

> With respect to Cussen J, I do not agree that evidence of similarities in fingerprints is not expert evidence, or that such similarities are matters which "the jury could determine for themselves". (*Bennett* 2005, [3])

The Acting Chief Justice then moves to clarify the orthodox common law position:

> Identification of similarities in fingerprints is a highly technical matter requiring considerable expertise and experience. I have regularly instructed juries not to attempt to make such a comparison themselves.
>
> This does not mean that the jury must necessarily accept expert opinion on the matter. For example, they may find the evidence unconvincing; they may have doubts as to the independence or qualifications of the expert; *they may not be satisfied that there are sufficient points of similarity*; there may be a conflict of expert evidence; they may suspect police tampering with the evidence. (*Bennett* 2005, [4]-[5] italics added)

This approach embodies a blend of deference and, where prints are presented, scope for some assessment of the reasoning or basis provided. The problem is, of course, how is the trier of fact to evaluate the opinion when only provided with superficial or misleading explanations of practice (Hand 1901; Martire and Edmond 2017)? Expectations on the trier are compounded by the fact that they are never told about the incidence of error, the examiner's proficiency, the frequency of specific features, how examiners distinguish between real as opposed to artefactual differences, account for distortion, and other limitations with procedures, not to mention the management of bias. Being told that fingerprints are unique and that two (or more) fingerprints match (or are 'identical'), and even drawing attention to similarities, does not provide an appropriate framework for rationally evaluating feature comparison evidence – see Section 1.B.

E. Disclosure of prior criminality

In terms of the fairness of criminal proceedings, several reported challenges address defence concerns that adducing evidence of a fingerprint match might be understood, by the jury (and judges), as evidence of prior criminality (e.g. *R v Fennell* 2017, [91]ff; *R v Ahola (No 6) 2*013; *Kuehne v R* 2011, [20]–[28]). For, unless the manner in which the defendant's fingerprints came to be compared with any latent prints is explained, it might reasonably be assumed that they came from a criminal database (or file) and are in that database because of some non-trivial prior offending.

Once again the challenge is not to the accuracy of any identification but rather to the implications that flow from it, namely the likelihood that the evidence implies some other kind of criminality. In general, courts have been unsympathetic to such arguments. In the absence of explanation, and even with it, decision-makers might use reasoning processes, such as tendency (i.e. propensity) reasoning or draw bad character inferences, that are

formally forbidden. In cases where a latent fingerprint is the primary evidence, there will often be a danger of unfair prejudice from such reasoning (Edmond 2017).

F. Moving beyond categorical identification

One set of challenges is focused on fingerprint examiners offering opinions that extend beyond the issue of identity (or *source*). These are sometimes opinions about *activity* – what the person was doing when the print was deposited – or opinions about the age of a print. Generally, examiners are not permitted to say much about what a person might have been doing when they touched an object, other than to describe the orientation of the finger or hand in relation to the touch. Similarly, other than general information about the persistence of prints, examiners are usually prevented from speaking about the age of prints. For, this is not necessarily part of an examiner's expertise.

Nevertheless, prosecutors and fingerprint examiners do not always restrict themselves to opinions about the source of prints. And, where transgressive opinions are admitted, such as the possible age of a latent print located on a library book in *R v SMR* (2002; see also *Mahmood v Western Australia [No 2]* 2008] [55]ff, [225]; *Mansell v Western Australia [No 6] 2*013, [137]–[139]), appellate courts have been known to excuse the contravention. Though, whether a fingerprint in blood could be attributed to a specific time (consistent with the defendant's opportunity), where the examiner did not know about the rate at which blood dries, the extent of the blood pooling at the scene, or the prevailing climatic conditions, the Court of Appeal found the admission of the examiner's speculation to have been improper (*Hillstead v The Queen 2*005, [50], [52]ff).

These cases raise epistemological issues – but they are not focused on identity. Examiners may be able to speak to some of these issues in a general way, such as the persistence of fingerprints in certain conditions if there are independent studies or evidence (e.g. of cleaning). But, in general, there will be no ability to go much further than to report a match decision (and its known limitations).

G. Investigator impropriety

Exceptionally, defence counsel challenged an identification by fingerprint on the basis of some kind of misconduct by investigators. That is, the latent fingerprint used to link a person with a crime might have come from a different place or have been fabricated (e.g. *Lawless v The Queen* 1979). These allegations are revealing because they suggest that some defendants and their counsel considered it easier, or more likely to be effective, to make arguments about investigator impropriety, including criminality, than to raise the possibility of an error (e.g. *R v Meldrum and Borchert* 1995, [65]ff; *Hunter Quarries Pty Ltd v Morrison* 2017, [441]–[442]; *R v Robinson* 1999; *Palmer & Ors v The Queen & Anor* 1998). This seems to confirm that lawyers tend to accept the near infallibility of latent fingerprint comparison, such that misconduct is the most plausible explanation for an identification said to be mistaken (e.g. *Bennett* 2005, [5], 'police tampering').

In the saga of the Mickelbergs (*Mickelberg v The Queen* (1992, 2004, [30]), a series of wrongful convictions involving serious police malfeasance, the concern with latent fingerprint evidence focused on whether it was forged or planted. The accuracy of this latent fingerprint comparison (and the match) was taken-for-granted, so the focus was on investigator malfeasance. In some cases dishonesty, or serious problems with the continuity of evidence, might be plausibly advanced by the defence. Nevertheless, the fact that there appear to have been more challenges to the integrity of investigators than the validity and accuracy of the procedure, or the proficiency of examiners, seems to reveal something about the focus and perhaps technical capabilities of generations of lawyers and judges.

Here again, the underlying reliability of identification by latent fingerprint is not challenged, rather it is the particular process and the credibility of specific personnel that are impugned.

H. Judicial directions, instructions and warnings

Given the lack of legal engagement with mainstream scientific research and advice, judicial directions and warnings tend to be superficial, unhelpful, and even misleading. They are always displaced from scientific knowledge (see e.g. Judicial Commission 2002, 2.210, 2.110). There have been challenges to the way latent fingerprint evidence was handled by judges, but these are not engaged with validity or scientifically-based ways of characterising (or expressing) and evaluating the evidence. Most are concerned with more superficial issues or the allocation of the burden of proof (and the implications of fingerprint evidence).[5]

The very first appeal affords an extremely clear indication of the problem with reliance on trial judges, and other legal personnel. Blacker's appeal was dismissed, in part, because of the rigor of the trial judge's directions. A century before scientifically-based insights were available, before the training of examiners was formalised and early procedures standardised (by convention), the opinion evidence was nevertheless said to have been 'carefully given and thoroughly tested'. The Court explained:

> The jury also were very carefully directed by the learned Judge as to the risk of error to which evidence of this class is open, and as far as the conduct of the trial is concerned every precaution was taken to guard against any wrongful impression being conveyed to the jury. (*Blacker* 1910, 360)

According to the Court of Appeal fingerprint comparison was a 'new science of identification … based on experiments'. But this was not a 'new *science*' and it was not 'based on experiments' that were directed toward determining accuracy or enhancing comprehension (*Blacker* 1910, 360; Cole 2001; Beavan 2001). There is no evidence of meaningful testing or caution. Most of the real risks were not identified or explained – they were unknown. Judicial assurance was misguided. It was based on ignorance. Over time, as Section 3 makes clear, these commitments were nonetheless transformed into *legal knowledge* – said to be derived from the experience of judges. To varying degrees, in the absence of scientific insight into the manner in which fingerprint examiners should testify, judges allowed them to express categorical opinions about identity and, if questioned, to reject uncertainty, limitations, and error (as in *O'Callaghan* and *JP*). Many judicial pronouncements and 'explanations', offered in the name of fairness, were little more than prosecution advocacy, albeit inadvertent. Inattentive to validity and accuracy, trial and appellate judges endorsed and legitimised assumptions and subjective impressions as knowledge, even insinuating the honorific 'scientific' before scientific studies were eventually undertaken.

Problems with judicial regulation persist. Consider whether the burden of proof was shifted in *Maniaci v The Queen* (2000). There, the trial judge stated:

> Courts take judicial notice of the fact that no two people have identical fingerprints. If you are satisfied that an accused person's fingerprints have been found at an incriminating location or on an

[5] See e.g. *Tema v The State of Western Australia* [2011] WASCA 41, [73]ff; *R v Morgan* [2009] VSCA 225, [28]–[32]; *CMH (a child) v Bower* [2009] WASC 347; *Halmi v R* [2008] NSWCCA 259, [91]; *Chahine v R* [2006] NSWCCA 179, [33]–[34], [59]ff; *R v Maloney* [2004] NSWCCA 250, [42]ff; *Maniaci v The Queen* [2000] WASCA 195; *R v Peel* [1999] 2 Qd R 400; *Regina v Harrison* [1998] NSWSC 133 (CCA); *R v Bartels* (1986) 44 SASR 260; *R v Moore* [1982] Qd R 162; *Simic v The Queen* (1980) 144 CLR 319; *R v O'Callaghan* [1976] VR 676, 678.

> incriminating object, then that calls for some explanation as to how the fingerprints got there. (*Maniaci v The Queen* 2000, [8], [24]; *R v Moir 19*12; Cf *R v Skinner* 1994)

On appeal, this statement, and the expectation that the defence ought to offer 'some explanation', rather than rely on reasonable doubt – such as from the best available indication of error, around 1 in 306 advanced by PCAST following the first-ever validation studies published in 2011 – was not deemed inconsistent with the presumption of innocence or the burden of proof (*Woolmington v DPP* 1935; *Azzopardi v R* 2001; *Palmer v R* 1998; *Dyers v The Queen* 2002; *X7 v ACC* 2013; *CFMEU v Boral Resources* 2015). In the absence of relevant knowledge, the fingerprint examiner, the prosecutor, and the judge all overstated the value of the fingerprint evidence and its implications. The Court also took judicial notice of uniqueness (even though there was not even legal consensus on this point – see *Parker,* discussed in Section 5.C), and without considering any limitations, or omissions, expected the defence to respond – before the foundational studies commenced in 2009.

Similarly, in *O'Grady v The Queen* (2012), the 'presence of' latent prints led the trial judge to repeat the prosecutor's contention that it required an explanation.

> The prosecution bears the onus of proving an accused's guilt beyond reasonable doubt and an accused person does not have to prove anything, he is presumed to be innocent unless and until the prosecution prove him guilty beyond reasonable doubt. *On the other hand, in this case, the Crown submits that if there was an alternative explanation to the presence of fingerprint and palm print then that explanation would be known to the accused and, in the absence of any explanation from the accused about the fingerprint and palm print, you may find it easier to accept the prosecution case.* It is up to you to decide what weight you give to that submission by the Crown about the absence of any explanation for the fingerprint and palm print. However, once again I remind you that you cannot treat the accused's silence as an admission of guilt or as filling in any gaps in the prosecution case. There may be good reasons unknown to you why an accused would choose not to give evidence. (*O'Grady v The Queen* 2012, [36], italics in original; Cf *Whelan v Police,* 2005)

The defendant has no evidentiary obligations here. Where epistemological limitations are known to the parties or the court, the defendant might rely on the fact that studies reveal that when tested, in conditions where the correct answer is known, experienced examiners make small numbers of errors. Authoritative criticism and the first generation of validation studies were available at this stage. These were not raised by the defendant, notwithstanding legal representation. By not disclosing limitations and uncertainties – even in cases where multiple fingerprints reduce the risk of error – fingerprint examiners and the prosecutors act in ways that are inconsistent with their formal obligations and inimical to the viable operation of an adversarial system that is unavoidably asymmetrical in its distribution of resources.

From the very beginning, trial and appellate judges have endorsed the unqualified opinions of examiners or given 'assistance' that was ignorant and in many cases misguided or misleading. These were almost always predicated upon an approach to latent fingerprinting comparison informed by credulity toward the prosecutor and the fingerprint examiner notwithstanding the fundamental institutional interest in rectitude, the fairness of proceedings and, more recently, the statutory obligation to focus on 'knowledge' in UEL jurisdictions.

I. The significance of fingerprints and other challenges

In many cases identification is conceded and it is the meaning or significance of fingerprint evidence that is in issue. Investigators, prosecutors and judges tend to expect an explanation when fingerprints link a person to a crime. Sometimes fingerprint

evidence is presented to a suspect after they have volunteered an innocent version of events in an attempt to obtain a different (responsive) version, thereby securing the loss of credibility associated with inconsistent versions of events. In other cases, those accused of criminal acts sought to draw attention to the fact that their fingerprints were not recovered or that the fingerprints of other unknown, though perhaps guilty, persons were.

The appeals in *Dhanoa v R* (2003, [63], [95]) reviewed convictions for kidnap and assault. The NSW Court of Criminal Appeal and the High Court both accepted that 'once the appellant was confronted with the fingerprint evidence he was bound to, and did concede that he had at some relevant time been in [the] flat.' The main issues were whether Dhanoa was in the flat when the assault occurred, the significance of an initial denial of having been to the flat (before he was confronted with the fingerprint evidence), along with the need to warn the jury about issues with the complainant's identification evidence.

Fingerprint evidence raised issues of credibility in *R v Zurek* (2006, [13]). Not only were unidentified fingerprints invoked in response to this prosecution for burglary, but the Court of Appeal considered that:

> … the absence of fingerprints or any marks or damage around the ceiling in the area of the rather small skylights, which the appellant highlighted in his address, did raise a real question as to whether he could have got in that way and thus whether, if he had made admissions to that effect, those admissions were true. (*Zurek* 2006, [31]; see also *Ghebrat v The Queen* 2011, 143)

Fingerprint evidence is understood as definitive evidence of identification. An expectation has arisen (see Section 4.H) that defendants who contend they are not guilty must provide an explanation for the presence of *their* fingerprint(s). Contests around the meaning of fingerprints or their absence have assumed such significance because defence counsel almost never challenge an identification or draw attention to the possibility of error. In cases where fingerprints are not recovered, it is not uncommon for prosecutors and judges to refer to the notorious fact that the absence of fingerprints might not mean very much because fingerprints could have been overlooked, destroyed, cleaned or avoided with gloves – and these possibilities might even be used to suggest degrees of premeditation.

There were other legal challenges, such as those concerned with: collecting fingerprints from a minor (*Police (NSW) v JC* 2016); the use of those fingerprints (*R v Sarlija* 2005 and 2006); whether adequate caution was given prior to taking fingerprints (*Milner v Anderson* 1982; see also 4.C); the hearsay implications of fingerprint records (*Re Pong Su (No 18)* 2005); and the cross-admissibility of fingerprint evidence (*R v Elgueta* 1999, [20]ff; *R v Mayfield* 1995). None of these contests raised significant epistemological issues. Most were directed toward having fingerprint evidence excluded because of pervasive impressions of it as conclusive proof of identity.

5. EPISTEMOLOGICALLY-INFLECTED CHALLENGES: *JP* AND *NGUYEN* (AND *PARKER*)

In this section we have brought together the only reported decision that directly raises epistemological issues as well as the two epistemologically-focused challenges known to us. Let's start with *Parker,* the only genuine expression of judicial concern in Australian legal history.

A. *Parker*: A Chief Justice dissents

The case of *Parker* stands out against every subsequent Australian decision because it is the only reported occasion when a judge (or court, see also Section 5.C) voiced epistemological concerns about the value of latent fingerprint evidence, as well as its scientific pretensions. It is all the more remarkable given that the appeal was not ostensibly concerned with admissibility (or reliability), but whether latent fingerprint evidence alone could support proof of guilt beyond reasonable doubt where identity was in issue – Section 4.B. In deciding the issue, the Chief Justice of Victoria referred to the 'extreme danger' of deferring to the opinion of the fingerprint examiner. Perhaps prescient, Madden CJ questioned the scientific basis for latent fingerprint evidence.

> We are asked to accept the theory that the correspondence between two sets of finger-prints is conclusive evidence of the identity of the person who made those prints as an established scientific fact, standing on the same basis as the propositions of Euclid or other matters vouched for by science and universally accepted as proved. If this finger-print theory were generally recognized by scientific men as standing on this basis, there would be no more to be said. It is said that the markings on the fingers of any individual retain their special characteristics from the cradle to the grave, and also that the markings on the fingers of no two individuals are the same, so that absolute correspondence between a finger-print and the markings on a man's hand is unmistakable evidence that he is the person who made such print.
>
> My difficulty arises from the fact that the subject of fingerprints has not been sufficiently studied to enable these propositions to be laid down as scientific facts. Finger-prints have been studied by Monsieur Bertillon in France from an anthropometrical point of view, and by Sir Francis Galton and a, few others, doubtless highly intelligent persons, from the standpoint of mere observers. But the matter has not been investigated by scientists generally so that we can say that the propositions relied on by the Crown are accepted scientific facts. (*Parker* 1912, 154)

The Chief Justice questioned the underlying assumptions – about permanence and uniqueness – as well as the scientific pretension of this new feature comparison procedure. He wondered how the witness' evidence, particularly about fingerprints being unique, could be tested.

> But it is said that Detective Potter has himself examined 29,000 persons and found the finger-prints of no two alike. … How could his evidence be tested? He says he has examined 29,000 persons with this result. Who can say he has not, and how can his statement be tested on cross-examination? Nobody can, and therefore the identity of the prisoner would rest on his ipse dixit. (*Parker* 1912, 154; see also *Kumho Tire v Carmichael* 1999, 157)

The inability to test the evidence, combined with 'a savour of mystery' is said to make the identification by latent fingerprint an extremely dangerous type of evidence.

> But when the detectives swear that no two men's finger-prints could possibly be alike, I think that that is apt to be accepted by the jury, who have no personal knowledge to test it by, and it cannot but be very bad for the prisoner. (*Parker* 1912, 155; see also *HG 19*99, [44] and *Honeysett v The Queen* 2014, [45])

Here, at the very origins of the institutionalised forensic sciences in Australia, we can observe one of the most senior judges in the country being attentive to the need for independent knowledge so that the evidence might be tested and rationally evaluated.

B. Admissibility challenges

Notwithstanding *Parker*, and the many changes to the practice of fingerprint comparison after 1912 (discussed in Section 6), it was not until 2015 that an Australian lawyer – a junior barrister representing a minor in the Children's Court in Dubbo – actually conducted the first epistemologically-inflected cross-examination.

i. JP v DPP*: A non-compliant report 'repaired'*

The case of *JP v DPP* reveals much about the complacent attitude of fingerprint examiners, prosecutors and courts. Notwithstanding adjectival rules, namely the *Evidence Act 1995 (NSW)* s 79 and the Code of Conduct for Expert Witnesses, regulating the admissibility and form of expert opinion evidence in NSW, the standard police pro forma for fingerprint evidence failed to explain what was done, who was involved, provide reasons, identify limitations and uncertainties, engage with proficiency, or cite any scientific literature. The actual Expert Certificate in *JP*, purporting to identify a single latent print to JP – and said to be based on 'specialised knowledge' – was little more than the kind of ipse dixit that so concerned Madden CJ in *Parker* (see Edmond, Martire and San Roque 2017).

On the voir dire defence counsel challenged the expert report (or certificate) and the associated opinion identifying JP as the youth responsible for an aggravated burglary. As part of that challenge, and drawing explicitly on the article 'How to cross-examine forensic scientists', counsel asked the examiner about his procedure and its validity and accuracy, his proficiency, dangers from cognitive bias, verification processes, the US and Scottish reports and so forth (Edmond et al 2014a). In response, the examiner explained that the ACE-V process was infallible when 'used in the correct method and way and by myself', insisted that he had never made an error, and testified that he was certain that JP left the fingerprint. Part of the cross-examination is reproduced in Section 3.A. He also testified that he had not heard of any of the scientific reviews of latent fingerprint comparison and preferred NSW Police procedures to the extent there were any differences. When pushed the examiner dismissed the independent scientific reports as 'someone's opinion in America' (Edmond, Cunliffe, Martire and San Roque 2019).

The magistrate found the certificate compliant, the opinion admissible and concluded that the examiner was not 'shaken' by cross-examination that exposed his lack of familiarity with the most important development in his 'field' in recent decades and perhaps ever. On appeal, the Supreme Court found the Expert Certificate to have been non-compliant with the requirements of the Code of Conduct, but the examiner's answers in cross-examination were said to have cured the deficiencies. Without eliciting any obvious knowledge, the defence somehow repaired the report thereby rendering the opinion admissible.

What is remarkable is that none of the judicial officers in *JP* engaged with the detail of the examiner's testimony or the critical scientific materials – discussed in Section 1.B – raised during the proceedings. Rather, long legal reliance and the experience of the fingerprint examiner seems to have been sufficient (Cole 2004), notwithstanding authoritative scientific rejection of legal use and practitioner experience as credible bases for scientific and technical forms of expertise, and UEL s 79 expressly calling for 'knowledge' (PCAST 2016, 55-56; Edmond and Martire 2017a).

This was the first epistemological challenge to latent fingerprint evidence in Australia that we are aware of – even though the epistemic dimensions of the challenge were not reported. The specifics of the challenge and the scientific materials assembled by defence counsel are not cited or discussed in the reported decision. Indeed, the appeal affords very limited insight into the serious epistemological issues that were raised though elided during the trial. The case reveals the difficulty of trying to cross-examine a witness who is unfamiliar with consensus reviews by peak scientific and technical organisations. The examiner's ignorance meant that he would not accept the authority of reports of unquestioned authority, consequently they could not form part of the record (Edmond, Hamer and Cunliffe 2016).

ii. The Queen v Nguyen*: Inability to shake a more informed examiner*

More recently, in *The Queen v Nguyen* (2018, 1-13, 1-21), a barrister, relying on an unpublished paper circulated by defence counsel from *JP*, sought to challenge latent fingerprint evidence in a case where the identification was based on multiple latent prints. In this case, the fingerprint examiner was much better informed. Though, notwithstanding the examiner's familiarity with the scientific reports and some of the research on which they drew, the transcript conveys a discernible partiality – a pro-prosecution defence of 'the science'. This is instantiated in the tendency: to rely on uniqueness (1-13, 1-21); to persist with categorical identification without meaningful qualification (1-21); to selectively invoke favourable assessments – e.g. foundational validity – but omit less favourable assessments – e.g. questions about the validity of ACE-V as applied (1-14, 1-20); to characterise fingerprint comparison as an objective process (1-14); to imply cognitive bias was mitigated by ACE-V (1-15, 1-22, 1-24); to suggest that the NRC report was 'United States specific' (1-19); not to concede the reality of error; and to misrepresent (perhaps based on a methodological misunderstanding) the implications of some of the most important contemporary research (1-15-16). Curiously, in responding to questions the examiner did not explain the evidentiary significance of recovering three different latent prints at the crime scene.

Counsel in *Nguyen* struggled against the (reasonable) presumption that the evidence would be admissible. Confronted with a relatively sophisticated fingerprint examiner he was unable to make headway. Effectively following a script (and not technically adept), counsel was not in a position to interrogate serious omissions and problematic answers with insightful follow-up questions (Edmond, Cunliffe, Martire and San Roque 2019). Following a guilty plea there was no trial, no review and no documentation readily accessible to others. The only persons who know of and read the transcript from *Nguyen* (and *JP*) are attentive latent fingerprint examiners – especially trainees.

JP and *Nguyen* were both recent, and related, admissibility challenges. They provide an indication of an emerging awareness, among a handful of defence lawyers, of deficiencies with latent fingerprint evidence. As things stand, these cases could be invoked, by those seeking to defend our adversarial system, as support for legal awareness of scientific research, an ability to challenge evidence and stimulate appropriate judicial responses. However, that would be a tendentious assessment. These cases are historical outliers and both suggest the practical ineffectiveness of cross-examination. Moreover, the transcript reveals that these lawyers, unusual for their willingness to ask epistemologically-oriented questions, struggled to apply the wealth of available scientific resources to successfully extract appropriate concessions, demonstrate limitations, undermine credibility, and discomfort judicial officers.

In consequence, neither *JP* nor *Nguyen* provide much assistance. With the expert reports, submissions and transcripts all invisible, the cases seem to actually affirm traditional legal practice and commitments. From a distance, adversarial testing seems to have confirmed the value of latent fingerprint evidence as complete evidence of identity. After all, according to the judges, these fingerprint examiners were not shaken by what is, implicitly, rigorous forensic testing. Indeed, from a distance – and through the opacity of appellate description in *JP* – these cases might be invoked as support for the admissibility of categorical fingerprint evidence, in conjunction with the legal acceptance of uniqueness, the practical infallibility of ACE-V, the unlikelihood (even impossibility) of error, the accuracy of the method and so on.

C. *Parker* and criticism of uniqueness

Finally, there is a curious inconsistency between the way fingerprint evidence is routinely presented – as categorical identification – and a proscription flowing from *Parker* (and *Ghebrat v The Queen 2*011). The ability to individualise persons from one or more fingerprints is frequently linked to the contention that fingerprints are unique. The syllogistic reasoning runs as follows:

1. Fingerprints are unique.
2. A fingerprint examiner claims that latent fingerprint A matches a fingerprint belonging to JP.
3. Therefore JP deposited fingerprint A.

This approach is misconceived for several reasons (PCAST 2016, 61-62). First, we can never test whether fingerprints are unique, or even whether parts of fingerprints (i.e. most latents) are unique. Fingerprints are highly variable, and may be unique, but uniqueness is an assumption and is not essential for fingerprint comparison to have significant evidentiary value. Secondly, regardless of whether fingerprints are (or are not) unique, that does not address the adequacy of match decisions. And, problematically, fingerprint examiners occasionally make errors – both false negatives and false positives. The alleged uniqueness of fingerprints does not resolve the issue of why some matches are erroneous, or whether an error has been made in a particular case. The procedure is subjective and inescapably error prone. The examiner has to determine whether the latent print is sufficient for comparison, compare the prints and decide whether any differences are 'real' or 'artefactual'. For, fingerprints are never identical (NIST 2012, 204). Errors come from the subjective nature of such interpretive activities and the risk of error may be accentuated where prints are on the margins of sufficiency, exhibit significant differences (and similarities) that may be real or artefactual, and cognitive bias (e.g. suggestion) is not managed.

This point is important because examiners and courts (as in *O'Callaghan, JP* and *Nguyen*) have conflated assumptions about uniqueness with the accuracy of identification. This conflation appears at the very beginning, when the High Court used an analogy with handwriting, to explain that fingerprint evidence was idiosyncratic. In refusing leave to appeal in *Parker*, the Chief Justice of Australia offered the following obiter:

> The fact of the individuality of the corrugations of the skin on the fingers of the human hand is now so generally recognized as to require very little, if any, evidence of it, although it seems to be still the practice to offer some expert evidence on the point. *A finger print is therefore in reality an unforgeable signature.* That is now recognized in a large part of the world, and in some parts has, I think, been recognized for many centuries. (*Parker* 2012, 683 italics added; *Clark v Ryan* 1960, [5])

Significantly, in the Victorian Court of Appeal the judges had unanimously rejected this very contention. Notwithstanding Madden's CJ dissent, the Court questioned the claim about the individuality (or uniqueness) attributed to fingerprints. The other judges agreed with Madden CJ: that 'the statement made by the expert witnesses that there could not be two finger-prints alike should not have been admitted, because … their knowledge or the knowledge of anyone else on the subject does not profess to be based on any universal law, but is merely empirical' (*Parker* 1912, 155). That is, it was based on personal experience. Justice Hodges did not think it 'necessary to say that there could not be any other finger-mark in the world like it' and agreed 'with what the learned Chief Justice has said as to the admissibility of that piece of evidence' (*Parker* 1912, 158). Justice Cussen indicated that fingerprint examiners might identify differences (for exclusionary purposes), but as far as identification was concerned they could merely

point out similarities to the jury for its consideration (*Parker* 1912, 161; Cole 2011). The headnote in the Argus Law Reports summarised: 'Evidence by experts that no two finger-prints can be identical is not admissible as being the statement of a scientific fact based upon a universal law' (*Rex v Parker* 1912).

These concerns were independently endorsed a century later on appeal in *Ghebrat v The Queen*. Summing up, the trial judge had said:

> If the characteristics of the two patterns of fingerprint samples have been found to match at a sufficient number of points, it is possible to say with certainty that the samples came from the same person and if you accept that, that evidence can be used to find that the fingerprints were from that person. … In this case, the expertise of Mr Gordon [the examiner] was not challenged, in other words, it was not said that he is not an expert, but the suggestion put to him was that like any human bring, he can make a mistake; it is a subjective judgment that he makes, *although he said it did not happen certainly in this case.* (*Ghebrat* 2011, [27]-[28] italics in original)

Here we can see the consequence of the unstated assumption about uniqueness manifesting. If there are sufficient similarities (here 'points') then the individual can be categorically identified: in *Ghebrat* the identification is characterised as mistake-free. The Court of Appeal was concerned that the summing up may have been misleading:

> … the jury could well have been unsure whether fingerprint matching involved a matter of simply reaching a sufficient number of points of similarity or not … the judge's summary would have left the jury with the impression that the process undertaken had been completed to a point that established certainty when this was not supported by the evidence. (*Ghebrat* 2011, [32])

What is perhaps most remarkable about *Parker* and *Ghebrat* is that these concerns and their implications have been ignored not only by fingerprint examiners and defence counsel but also by prosecutors and trial judges.

A problem at the heart of latent fingerprint comparison is that once examiners are prevented from equating a match with categorical identification of a specific person, as these judgments seem to require (and Cussen J makes explicit), the question of what examiners can legitimately opine arises (Cole 2005, 2009). Here, problems with the frequency, distribution and inter-relatedness of features, as well as the question of error (e.g. how often are very similar looking partial prints from different persons mistakenly matched), emerge front and centre (Cf *R v Lucas* 1992, 118; *R v Ngo* 2001, [1]-[7]). For, in the absence of uniqueness examiners can only suggest that similarities are probative to some unknown – though non-trivial – degree (AAAS 2017). Fingerprint examiners have historically hidden behind uniqueness and assumed (or pretended) that it effectively circumvented the need to address fundamental methodological and statistical problems.

6. UNCONTESTED: METHODOLOGICAL, TECHNOLOGICAL AND OTHER CHANGES

Other than in the cases described in Section 5, there is little discussion of the 'science of fingerprints'. Given the historical lack of scientific support this circumstance is surprising and should unsettle conventional accounts of the effectiveness of adversarial testing and specifically trial safeguards. The lack of epistemological challenges is all the more remarkable given the level of change – both methodological and technological – that transpired across the twentieth century and beyond. Non-trivial changes include: the slow development of fingerprint bureaus and their institutionalisation; introduction of formal training and certification; changing methods for collecting fingerprints from crime scenes; the introduction of electronic collection and storage systems (e.g. Livescan); the

introduction of algorithms for searching the rapidly expanding number of electronically accessible prints (e.g. NAFIS); abandonment of the point system and the move to holistic analysis (Evett and Williams 1996; Cf *R v Buckley* 1999);[6] the adoption of ACE-V (bare references in *JP*, *Ghebrat* and *Wright v WA 2*010, [253]); new chemicals and apparatus for visualizing fingerprints (e.g. ninhydrin in *R v Mackenzie* 1995); the Splatt and Chamberlain Royal Commissions leading to establishment of the National Institute of Forensic Sciences (now supervised by police); the use of digital photography to capture latent prints; the introduction of civilian fingerprint examiners (employed by police); 'independent' accreditation of fingerprint bureaus by the National Association of Testing Authorities (repeatedly signing off on validation under ISO 17025 before it was achieved); the formation of technical and professional societies (with ethical obligations, e.g. International Association for Identification and the Australian and New Zealand Forensic Science Society); the appearance of scientific critiques by the NAS, NIST, PCAST and the AAAS (from 2009); the first validation studies (published by Ulery et al, in the US and Tangen et al in Australia in 2011), and so on. A search of the leading cases and databases might lead one to infer that nothing of significance happened during the century. Hardly any of the institutional, methodological and technological developments, some profound, seem to have inspired much in the way of disclosure, concession, challenge or comment.

The dearth of epistemological challenges is all the more curious because from 1998 there had been sustained (though ultimately unsuccessful) admissibility challenges in the US (e.g. *US v Mitchell 2*004, 235-241; *US v Llera-Plaza* 2002; Cf *Tang* 2006, [145]; Cole 2005).

7. CONCLUSION

This analysis of reported decisions suggests that prosecutors and judges believed they were administering pre-trial procedures, trials and appeals in ways that were fulfilling institutional and societal expectations. They appear to have believed that trials were fair, that forensic science evidence was properly expressed, explained and, where appropriate, tested. Yet, there is no *report* of a lawyer or judge ever requiring a latent fingerprint examiner – who claimed to have categorically identified a person – to address the questions: Can you do it? How good are you? And, how do you know? There is no discussion of the validity and accuracy of the different procedures (culminating in electronic databases, search algorithms and ACE-V), employed across more than a century of use. There has been no meaningful engagement with authoritative scientific reviews and associated research. Nevertheless, Australian courts continue to allow latent fingerprint examiners to make categorical statements about identify without reference to limitations or an indicative error rate. Australian lawyers and courts are yet to require fingerprint examiners, and many other forensic practitioners, to present their opinions in 'scientifically plausible' terms (NRC 2009, 142; AAAS 2018, 9).

This study reveals a great deal about adversarialism as well as our legal institutions and personnel. While cross-examination can be a very effective forensic tool, the

[6] The number of points arises sporadically, though usually in response to prompting in cross-examination. See *R v Graham* (2017) 325 FLR 21, [43]; *CZB v Children's Guardian* [2017] NSWCATAD 208, [86]; *JP*, [27]; *R v Milos* [2014] QCA 314, [132]; *HZXD v Innovation Australia* (2010) 80 ATR 939, [17]; *Soutar v Commissioner of Police* [2006] NSWDC 95, [60]; *R v Tang* (2006) 65 NSWLR 681, [144]; *Bennett v Police* [2005] SASC 167, [15], [17], [39]–[40]; *Bennett v Police* [2005] SASC 415, [5]–[7], [22], [23], [28]; *Mickelberg v The Queen* [2004] WASCA 145, [186]–[187], [192], [310], [320]–[322], [328], [329], [337], [487], [526]; *R v Burling* [2002] NSWCCA 298, [19]; *R v Walsh* (1993) 70 A Crim R 408; *Re Niko Tomicic v R* [1989] FCA 333, [16]; *R v Moore* [1982] Qd R 162, 169; *MacDonald v A-G (Cth)* (1980) 24 SASR 294, 299.

questioning of forensic scientists is quite often technically ignorant, misguided and ineffective. Leaving reliability (and validity) issues for the trial – in reality for the defence and the jury – has not worked. The dearth of epistemological engagement, and the apparent widespread ignorance of this limitation, suggest that the system is failing and is insensitive to its failings. Adversarialism has not led to the recognition of serious problems with the way latent fingerprint evidence was and is adduced, presented, challenged and summarised (and presumably evaluated) in courts.

In conclusion we want to make five brief observations. We begin with the systematic misrepresentation of latent fingerprint evidence. In almost every case where latent fingerprint evidence was raised – in witness questioning, in plea and charge negotiations, in inquests, in committals, during voir dires, trials and appeals, the value of latent fingerprint evidence was systematically mis-represented in ways that advanced the interests of the prosecution. It was routinely mis-represented as practically certain evidence of identity before and after appropriate scientific evaluation had been performed. Suspects, defendants, appellants and lawyers will have understood that the criminal justice system treated fingerprint evidence as practically insurmountable – even if identification was mistaken. Such attitudes and inveterate confidence in our adversarial system – rather than actual error-free performance by examiners – might help to explain why mistakes have not been identified.

Non-disclosure and non-recognition of the lack of evaluation suggests that our legal processes do not operate as trial and appellate judges envisage. Decisions about charging, challenges to the admissibility of evidence, indeed all attempts to evaluate the subjective opinions of latent fingerprint examiners, seem to have been undertaken on the basis of impressions, beliefs and institutional folklore rather than knowledge derived from scientific study. Not only were impressions, beliefs and institutional folklore misguided (indeed biased), but prevailing attitudes discouraged epistemological challenges. This condition persists.

In the absence of scientific insight into the value of latent fingerprint evidence, decision-makers were not provided with the information required to evaluate this opinion evidence (Edmond 2015a). They were not provided with an indicative error rate or told about uncertainties and limitations. In consequence decision-makers were obliged to rely upon proxies such as examiner experience, the (cultural) plausibility of uniqueness and its implications for identification, how well the examiner performed in cross-examination (e.g. Were they shaken?), whether latent and reference fingerprints appeared similar (if provided), the fact that the evidence was admitted in serious criminal proceedings, and so on. Individually or in combination such proxies cannot validate a procedure, provide a reliable indication of its accuracy or an examiner's ability. Rather than rational evaluation they encourage speculation or deference.

One of the most disconcerting features of this account is the apparent inability to place mainstream scientific perspectives before trial and especially appellate courts (Cf *Aytugrul v The Queen* 2012; Hamer 2013). At no stage did courts ever require them, and even as they became available, prosecutors and judges did not exhibit interest. There are no references in any of the publicly available legal documents to mainstream scientific research and reports on latent fingerprint evidence. Instead, we encounter the opinions of latent fingerprint examiners about the value of their opinions, reiterated or endorsed by prosecutors and judicial officers. Our rules, jurisprudence and judicial attitudes seem remarkably antithetic to defence introduction of scientific critiques – however authoritative or destabilizing. Whereas we might have expected judges concerned about rectitude and fairness to be unsettled by mainstream scientific criticism, they have preferred to trust their traditions, the state's fingerprint examiners (including those

without relevant knowledge), and treat independent scientific research and advice with suspicion.

When eventually tested by Ulery (2011) and Tangen (2011) and their colleagues, latent fingerprint evidence turned out to be generally accurate, though not infallible. Subject to scientifically legitimate forms of expression, that incorporate limitations and provide an indication of accuracy, latent fingerprint evidence should be admitted and relied upon in Australian criminal proceedings. The story is much less clear with other untested or less reliable forms of forensic science and medicine. What courts should do with ballistics evidence, where firearms examiners purport to link ammunition to a specific gun on the basis of unique features is unclear (PCAST 2016, 111: 'falls short of … foundational validity'). And, what about blood spatter, shoe prints, tool marks, document comparison and a range of other pattern-based forensic sciences? The use of anatomists and others to assist with the interpretation of images has raised some judicial concern, but produced little in the way of guidance (*Honeysett* 2014; Edmond 2015b). Who should be able to interpret images and, as importantly, should we allow translators and investigators to make transcripts or interpret speech or identify speakers in sound recordings where abilities are untested and hence unknown (*Nguyen v R 2*017; *Kheir v The Queen 2*014; *Tran & Chang v The Queen 2*016; *Chen v R* 2018; Fraser 2019)? The fact that most Australian forensic scientists (and all ad hoc experts) operate in suggestive conditions, where those engaged in difficult interpretative tasks are unnecessarily exposed to suggestive information, accentuates problems and increases the risk (if not the awareness) of error, exaggeration and over-valuation (Edmond and San Roque 2012; Edmond et al 2014b).

Finally, it is important to distinguish legal engagement with DNA profiling evidence. For a number or reasons DNA profiling evidence might be considered exceptional – in comparison with latent fingerprint and many other *traditional* forensic 'sciences' (Aronson 2007; Mnookin et al 2011). Important differences include: DNA profiling (initially 'DNA fingerprinting') was originally developed by scientists rather than police and investigators (Lynch et al 2008; Harris 2012); independent scientists were publicly critical of some of the original forensic applications and this led to sophisticated defence challenges (e.g. *People v Castro* 1989); peak scientific organisations intervened (e.g. NRC 1992, 1996) to review practices and set standards; and, non-aligned biologists, geneticists and statisticians, called by the defence (compare the state's monopoly on the training of latent fingerprint examiners), participated in continuing technical challenges, particularly as new procedures and techniques appeared (see e.g. *R v Tran* 1990, 242; *R v Pantoja* 1996; *R v Karger* 2001; *R v Gallagher* 2001, [36], [62], [72], [114], [140]; *Tuite v The Queen* 2015). While the response to DNA profiling *might* be advanced as an example of legal success, the light it casts on legal responses to the other less studied feature comparison forensics is instructive. Why do we care about the validity and scientific reliability of DNA profiling evidence but not latent fingerprint evidence, and why is DNA profiling (and some forensic chemistry) expressed in probabilistic rather than categorical terms? As a science-based procedure, DNA profiling casts a bright and uncomfortable light on the traditional forensic sciences and the inconsistent performance of our adversarial legal institutions.

This article illustrates the importance of validity, scientific reliability and proficiency (and concern with cognitive bias) as admissibility criteria for many, perhaps most, types of forensic science and medicine evidence; but especially feature comparison procedures. Simultaneously, in demonstrating the inability of lawyers and judges to recognise serious methodological problems or engage with independent technical advice from organisations of impeccable authority, it suggests that our current legal personnel might be incapable of

effectively regulating forensic science evidence. Our judges are either oblivious to, or seemingly unconcerned with, a long century of adversarial mechanisms failing to operate as intended. Notwithstanding a professional ideology committed to rectitude and fairness, along with norms, rules and procedures said to facilitate those ends (Ho 2008), Australian judges seem to be ignorant, and are certainly mute, about serious structural problems and historical failures (Cf Maxwell 2019). Our legal personnel are yet to address many of the refractory issues haunting the forensic sciences of the twentieth century. It is hard to imagine they have positioned us well for the challenges of the twenty first.

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